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The Air Line Pilot

July, 1955

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10th IFALPA Conference
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What's Ahead In Cockpit Design?

Maybe You'll Agree Or Disagree With Parts Of This Article, But All Pilots Will Agree With Its Premise: Cockpits Are Too Complicated, Simplification Is In Order—A Safety Forum Report

By Lt. Comdr. George W. Hoover
U. S. Navy; Office of Naval Research

Every non-pilot who has taken a good look at the cockpit of a modern airliner has invariably made the remark that it is amazing how pilots are able to keep track of the maze of instruments and controls that confront them. Frankly there are a great many pilots who are just as amazed, although very few will admit it. Perhaps this unwillingness to admit that the cockpit is too complicated for efficient operation is one of the paramount reasons why pilots have to put up with such complexity. Pilots as a rule are inherently adverse to radical changes in cockpit configuration. Such reluctance is probably due to the fear of having to depend on less reliable equipment or of having to change habit patterns. The very fact that they are hesitant to change, however, indicates that they recognize the seriousness of their business and rebel against changes which might cause them to make a fatal error.

Increased Complexity

There has been one change in cockpits over the last twenty years that happened, acceptable or not — they have become more complicated. This is probably due to a compromise on the part of the pilots to accept new equipment providing standby equipment was also available. The complexity of the cockpit is also a result of the increased performance of the aircraft and the necessity to operate it for longer periods of time as well as during rather adverse weather conditions. Many things have been added to cockpits, but very few things have ever been removed. The pilots' acceptance of additional equipment is understandable because when things begin to happen fast in an airplane a pilot wants everything he can get which may be of some assistance in getting his airplane back on the ground in one piece. Herein may be one of the best indications that the present cockpits do not provide the pilot with adequate information to solve his problems without a terrific amount of mental gymnastics.

Dual Program Noted

If we are to make really significant progress toward development of a cockpit capable of being operated at any time, in an errorless as well as efficient manner, we should establish a *dual program*. In one program we must continue an everyday effort aimed at meet-

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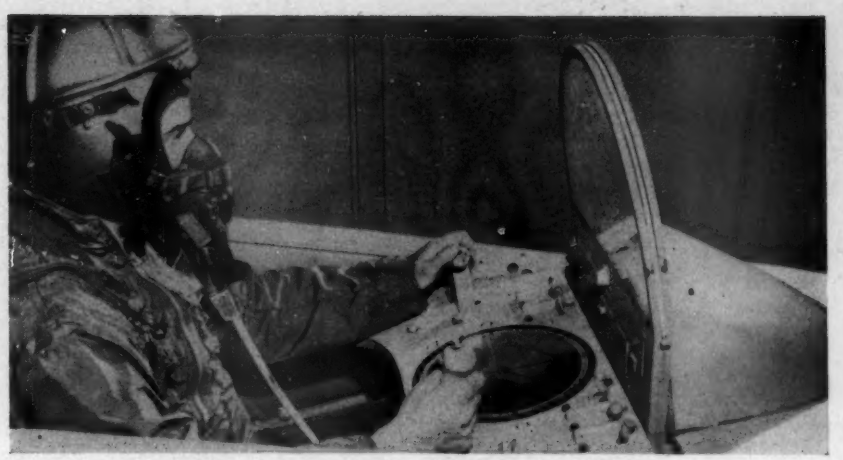
ing the immediate cockpit requirements by whatever means is available. Even sacrificing payload should be considered in order to provide the pilot with a completely adequate system of controls and instruments. This program can only accept the best compromise in order to provide equipment as quickly as possible. In addition to this program however, a long range program should be established in which all research and development would be aimed at a definite goal. Such a goal would consist of a cockpit system which would permit operation at any time regardless of weather (tornadoes, typhoons, etc. excluded), with a minimum of weight for the equipment, a maximum of reliability, and requiring a minimum amount of training. This long range effort should be carried on with completely uninhibited thinking, accepting no compromise, and constantly seeking absolute answers instead of interim solutions. Actually, as interim solutions became apparent, they would be fed back to the everyday program for implementation. Such a dual program would permit equipment design based upon known scientific facts rather than pilot or engineering opinion.

Pilots Know Problems

Any long range program, because of its concept will only approach its ultimate goal asymptotically; it must however, have a very definite starting point. In a research and development program, the starting point must be a complete statement of the problem in its most fundamental terms. Since the cockpit is to be used by pilots, then pilots are the only ones who can thoroughly state the problem by establishing their requirements.

One of the main reasons for not having adequate information in the cockpit is that pilots have never clearly stated *what it was that they wanted.* The average pilot, when asked what



Proposed Future Navy Cockpit

information he wants, will almost invariably state his requirements in terms of instruments and equipment, which he has flown before, rather than call for anything new. If pilots want an answer to the problem of instrument flight they must state the problem in fundamental terms rather than let engineers state it for them in engineering terms.

For example, let's look at the first phase of any flight, the take-off. Let's assume that this is an instrument flight, in order to determine exactly what information must be provided in lieu of visual conditions.

Alignment With Runway

We will discuss only two of the requirements in this phase of flight. The first bit of information required is the alignment with the runway. Here the pilot is concerned with his position with respect to the center line — not heading as given by a directional gyro or compass. Heading alone will not tell him where the edge of the runway is as he starts his take-off run. In contact weather this information is apparent and easy to use, so in some way we must find a method of reproducing an analogue of this data for instrument flight conditions. Thus we now have our first basic requirement—lateral position on the runway. No pilot can truthfully state that this is not necessary information. It is true that we make instrument take-offs without it, but it requires a great deal of concentration and continued practice.

Length of Runway

The second requirement is position with respect to the length of the runway. In other words, the question asked by the pilot is, can we get airborne before we get too far down the runway? This becomes very critical when operating from fields with short runways, in aircraft with high load and low lift characteristics. This requirement may not be a necessity at all times, but it would relieve the tension of the pilot, and it is still a basic piece of information.

For too long a time pilots have accepted compromises rather than demanded what they really wanted in the

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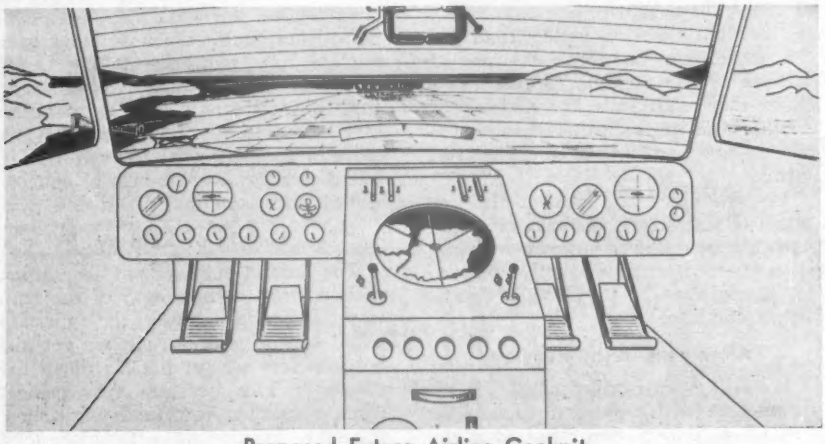
Ed Modes, Editor

cockpit. If simpler cockpits are ever to become a reality they will not be designed by engineers or pilots but rather by a team of engineers and pilots working with psychologists, medical doctors, and physicists.

It is rather evident that present day cockpits have been designed primarily by engineers because the controls and instruments are presented to the pilot as factors of an equation rather than answers to very important questions. Engineers think in terms of equations so it figures that the equipment which they design will be in the same terms. This is not meant to deride the engineers but rather to point out that the aircraft manufacturer may be hiring the wrong man to do the job. You don't ridicule a blind man when he stumbles, but neither do you hire him to do a job where stumbling might be critical.



Proposed Future Airline Cockpit

Role of Instruments

All that any pilot wants from his instruments is an answer, not factors. At the present time if a pilot wants to know where he is geographically, or even in terms of distance from his destination or point of departure, he must derive his answer from the bits and pieces of information with which he is provided. First he must read his airspeed, which because of instrument design is not true but indicated. Then he checks the outside temperature in order to correct his altimeter so that he can correct his airspeed for altitude in order to determine true airspeed. This tells him very little because airspeed must be tied in with the wind direction and velocity in order to get ground speed. Integrating ground speed for the time enroute will then tell him how far he has gone, and when this distance is plotted on some suitable chart or "how goes it" record, his original question will be finally answered. Some pilots are capable of doing this calculation quite rapidly and accurately and others make fatal errors. It is only necessary to build a computer which will do this calculation for the pilot and tell him continuously where he is at any given moment.

Actually, in order to get answers, there is no need to increase the overall weight of the plane if the equipment is designed as an integrated system. All instrumentation consists fundamentally of a sensor, an amplifier, a computer, and a receiver or instrument. With very few exceptions, almost every system in the airplane has its own sensor, its own computer, its own amplifier, and in most cases even its own power source. In the computers and amplifiers there are some circuits, which are almost identical in their function although not in their design. If all these common circuits were combined and operated on a time sharing basis the overall weight could be reduced considerably and the units could be made much more reliable. This can only be done however, if the *entire* system is redesigned. Simplification cannot be achieved if compromises are made to take care of the deficiencies of a part of the system. Once the requirements have been established for the overall control and instrument system, and an analysis has been made of the state of the art, the design of the equipments will become rather evident, and without any great degree of compromise.

Evils of Standardization

Another attitude which must be changed, if cockpits are to become more simplified, is the old idea that "if it was good enough for grandpa it is good enough for me". In the first place grandpa wasn't flying as often, as high, or as fast as we are today. There are two types of people who tend to have this attitude: the pilot who is reluctant to any change, and the manufacturer or engineer who doesn't want to take the time and effort to redesign. Incidentally these two types are always the strongest advocates of standardization, and indirectly they are actually sponsoring stagnation. This is not meant in any way to suggest the termination of standardization but rather to point out that too much standardization at the wrong time can retard advancement. Equipments have been severely hampered by certain so-called standard items such as electrical terminals, cable, couplings, etc. simply because these fittings were bulky, heavy, and designed from obsolete specifications. The utmost effort is made to eliminate every ounce of weight that can be spared in the prime piece of equipment and then because of the rules of standardization the entire development is burdened by a mass of heavy cables and fittings, which were designed for a completely different set of gear. If the piece of equipment is to be redesigned, then the associated parts should be redesigned also. Again, a very definite set of requirements must be established before the equipment design is started. If the requirements call for a different set of associated parts, then standardization must be abandoned for the sake of making the equipment adequate for its task. Actually, when any system becomes completely adequate, standardization will come about automatically as a by-product.

Points Summarized

Let us summarize the points covered:

1. Pilots should stop accepting and start demanding equipment for their cockpits. In doing this, however, they must overcome their reluctance to change.
2. Pilots must begin to state their requirements in fundamental terms rather than in terms of modifications to existing equipments. They should stop trying to design equipment and stick to their task of stating in precise terms the kind of information they require to accomplish their main job of operating the aircraft.
3. Air lines should establish a dual program. One to take care of the immediate problems and a companion program to look into the future and to seek ideal cockpits.

(Continued on Page 15)

The Montreal Story

ALPA Delegates at IFALPA parley. Shown, left to right: L. H. Mouden, 1st V.-P. Beatley, Pres. Sayen, Reg. V.-P. Masland.

Pilots' International Role Stressed At IFALPA Conference; Discuss Common Problems

By Capt. L. Homer Mouden

"United States of America" is separated from "Australia" by 16 countries. You will notice that this is true as you look over the alphabetical list of countries represented at the 10th Annual Conference of IFALPA held recently in the quarters of ICAO at Montreal, P. Q., Canada.

The air line pilot has truly become an international figure. Pilots are found in most of the nations of the world. In many of these countries they are flying in scheduled airline service operated by national air carriers. They have now gone much further and are organized into representing Associations. These are working for the common good of all pilots through their own organizations, banded together as The International Federation of Air Line Pilots Association, commonly known as "IFALPA." This Federation has grown from a three-member organization, formed by the Pilot Associations of Canada, Great Britain and the United States in 1945, to the 22-member Federation that now exists. It is continuing to grow through application for admittance by Pilot Associations in other countries.

Composition And Functions

These Associations of air line pilots vary in size from as few as 40 pilots to the near 10,000 represented by ALPA. Each member organization functions both as a representing union and as a technical association for presenting the pilot's viewpoint on aviation problems. Every organized pilot, whose Association is a member of IFALPA, has direct representation and participation in aviation items of interest through his National Association, and thence through the International Federation of Air Line Pilots.

IFALPA Conferees Study New Developments

Representatives Talk Over Mutual Problems

The countries represented by delegates from their Air Line Pilot Associations were: Australia, Belgium, Canada, Denmark, Finland, France, Greece, Holland, KLM International, Ireland, Israel, Italy, New Zealand, Philippines, South Africa, Switzerland, U. K., U.S.A.

Overcoming Language Barriers

The 1955 Annual Conference was held in the quarters of the International Civil Aviation Organization commonly known as "ICAO." This is located in the International Aviation Building at Montreal, P. Q., Canada. The facilities available were the finest that IFALPA will ever be privileged to enjoy. ICAO is set up to handle meetings in plenary sessions and in the committee rooms with a maximum of efficiency.

The Council chamber is designed and equipped to accommodate persons speaking in any of three languages. These are English, French, and Spanish. (Actually, the equipment available could accommodate three additional languages, if the need should develop.) This is accomplished by means of individual microphones, switching boxes, and ear phones for each desk or seat in the rooms. The speaker's voice is picked up by the microphone before him, his words are interpreted into each of the other two languages, and everyone can, by selecting the proper channel, hear the interpretation through his individual headset. Thus the speaker might be talking in French—one person could be listening to the English interpretation, while another is hearing the Spanish interpretation. Meanwhile, someone on the other side of the room might be listening to the speaker's own voice through the ear phones via a direct channel.

The system's success results from the work of the interpreters. These men and women have developed, to a high degree, the ability to listen to a speaker and repeat the context of the sentences in another language almost before a sentence has been completed. Anyone, who has ever been exposed to a foreign language in high school or college, will recognize that this is a very special talent, because the full meaning of a sentence is often incomplete until the last word of that sentence has been stated. It is indeed rare for the interpreters to be more than one sentence behind the speaker. For the IFALPA Conference, it was found necessary to provide only two languages, as all delegates and representatives understood either French or English.

The rectangular Council chamber is equipped with two concentric, elliptical rows of desks. In the center are facilities for stenographers and recorders. These persons always wear ear phones and copy verbatim everything that is said, either by the speaker or by the proper interpreter. One end of the rectangular room is lined with spotlighted flags of all the member countries, while the opposite end incorporates a blue glass behind which the interpreters' booths are located. Through this the speakers can be observed by the technician and interpreters without being distracted. This end of the room also contains a hidden projection booth, master control panels, and other such facilities.

On each side of the walnut-paneled room are located seats equipped with individual ear phones and switch boxes for the use of the visitors and special representatives. The indirectly lighted room was especially designed for its accoustical qualities, as well as its attractive appearance.

First Session

The first plenary session was convened on the morning of April 14, 1955. The Conference was welcomed by Air Vice Marshall Allan Ferrier in behalf of the Secretary-General of ICAO. Mr. Ferrier, in addressing the Conference of IFALPA, assured them of ICAO's interest and cooperation, explained the functions of ICAO, and outlined its limitation of authority.

Following the welcome by Mr. Ferrier, the President of IFALPA, Mr. Clarence Sayen, formally opened the Conference with the President's Report. He reviewed the progress of IFALPA and in so doing, pointed out that the mere fact of existence of this organization made it worthwhile.

President's Message

Mr. Sayen stated: "The fact that we can meet here, in the friendly and constructive atmosphere that we have had at all of the IFALPA sessions I have been privileged to attend, makes this organization worthwhile in itself. If we had nothing other than a fraternity—a world fraternity of airline pilots—which was purely a social institution, I think our existence would be completely justified. But we have more than that, because we have a vehicle, or means, by which our common problems or individual problems can be processed through a common ground of understanding."

He went on to outline how, once this has been achieved, IFALPA will become a vehicle representing that understanding on the international scene, or wherever it is needed. He indicated that there was little doubt that this organization must be continued, and that its effectiveness must be increased as a representative of the professional airline pilots because of the tremendous growth of the aviation industry. This has compounded the complexities of technical development, which, in turn, has created technical administrative problems for IFALPA.

Some years ago, pilots constituted a substantial percentage of the total airline employees, and, as such, represented a very powerful force. Today, on many of the air carriers, the pilot force has diminished percentage-wise to where the pilot represents some 6 to 7 per cent of the total employees.

"This being the case," Sayen stated, "there is an administrative challenge to each member Association of this Conference and to this Federation to maintain the pilot's position within this growth so as to maintain his authority and responsibility. This growth and expansion has created complexities, and because of this, the pilot's voice as a representative must now be a specialist's voice. We must have an effective representing organization, capable of processing specialized problems and of effectively representing the view of the professional pilot. This specialized representative must command the respect of the rest of the industry through his knowledge of the subject and the fact that he represents the true voice of the pilot group."

Role Of Association

Because of the size and complexity of this industry, pilot representation cannot cover all phases of aviation development. The member Associations and their organization, IFALPA, must decide in what fields we will concentrate our efforts; then, in those particular fields, we must give the industry the full benefit of our experience as a consumer of aviation processes and products.

He stated, "When we are faced with a new process or a new product, we have to answer two questions:

"1. Are the requirements of our job and the things we are being asked to do reasonable, and

"2. Are the tools furnished us with which to do the job adequate?

"If the answer to either one of these questions is negative, then we must have an organization to defend us, because we assume a primary responsibility in this industry for safety."

In conclusion, the President requested that the Conference consider three points:

1. IFALPA be continued and strengthened as an organization.

2. Each delegate give serious consideration to those steps, which will strengthen his own Association as a representative of the professional air line pilot.

3. That we all direct our attention to seeking out and stimulating the most capable people in our ranks to do pilot representation work.

Committees

(Editor's Note: The ALPA delegation consisted of William Masland, Regional Vice-President, 1st Region; Mr. E. A. (Chuck) Beatley, ALPA 1st Vice-President, and L. Homer Mouden, Chairman, ALPA Airworthiness and Performance Committee.

(Bill Masland was Chairman of the Subcommittee dealing with problems associated with Meteorology, Communications, and ICAO Regional Meetings; L. H. Mouden was Vice-Chairman of the Subcommittee handling problems associated with Airworthiness, Aircraft Types, and Aircraft Equipment; E. A. Beatley served on the Subcommittee dealing with conditions of Service and Disciplinary Procedures. Beatley and Masland also appeared before most of the other subcommittees.)

C. N. Sayen, as President of IFALPA, was not officially a part of the ALPA delegation. However, he was perhaps the busiest one at the Conference while working in the capacity of presiding officer, and with special committees, subcommittees, and special working groups.

Mr. Frank Entwistle, Chief of the Flight Branch of ICAO, was assigned ICAO observer to the Conference. Mr. H. Hutchons was an observer for the WMO (World Meteorological Organization).

The subcommittees and certain of the plenary sessions were assisted greatly by the technical members of the secretariat of ICAO, who were consultants and sources of technical information. The subcommittee dealing with problems associated with approach-to-land, including approach lights, beacons, fire-fighting equipment, etc., was assisted by Mr. J. M. Lerew, Chief, AGA. Mr. J. de Vienne, Chief, RAC/SAR, worked with the subcommittee handling problems associated with enroute procedures, route of the air, etc.

The subcommittee handling problems associated with Airworthiness, Aircraft Type and Aircraft Equipment was assisted by Mr. P. A. Puvrez, A/Chief, AIR, and Mr. W. J. V. Branch, Chief, PEL/TRG.

The subcommittee working on Meteorology, Communications, ICAO Regional meeting, etc., benefitted by the counsel of Mr. H. R. Adams, Chief, COM, and Mr. G. J. W. Oddie, A/Chief, MET.

Mr. P. M. Norman, Chief, OPS/AIG, assisted the subcommittee dealing with problems of personnel licensing, crew complement, and flight time limitations.

This coordination furnished delegates and working groups with background information relative to ICAO activities on the subject under discussion and aided in wording resolutions so that they expressed exactly the desired meaning to all member Associations and to other interested organizations. Perhaps the ICAO technical representatives' greatest value to IFALPA will come from their opportunity to understand fully the thinking behind the organizations' actions so that they can better reflect the pilot's viewpoint in future ICAO activities.

During IFALPA session, l. to r. (back row): Captains Miles, Mouden, Keig, Jaumoulle, Potter; (front row): Whitfield, Morton, Jackson, Arnkill.

The Agenda

ALPA members will be interested in all of the agenda items receiving action at the 10th IFALPA Conference, but certain subjects will be of more interest and value due to the particular nature of the problem, or because of a particular interest developed by the ALPA group. Some of these were the radar monitoring of ILS approaches, aerodrome fire-fighting equipment, VFR and IFR flight limitations, vertical separation and horizontal visibility, fuel storage in Civil aircraft, carriage of life jackets on overwater flights, authority and prerogative of the pilot, daily flight limitations, the maintenance of competency, the consumption of alcoholic beverages, flight time and on-duty time limitations, etc.

A total of 40 resolutions were acted upon during the Conference. Everyone of them is of interest and concern to the pilots of ALPA. Many of us will finish our entire flying careers without realizing how much we have benefitted, either directly or indirectly, from actions taken in our interest at such Conferences.

Some Highlights

Some of the subjects considered and the results of the plenary session actions are listed here. The full text of the resolutions will be available soon, and anyone interested in more specific information can obtain it through the Home Office. No attempt will be made to review all agenda items, but only to touch on those that seem to offer the greatest interest to ALPA members in general.

▶ **Flight time limitations, on-duty time, and rest time:** The subjects of daily, weekly and monthly flight time limitations provoked much discussion, with an apparent tendency on the part of representatives to base their convictions on their particular flight conditions. A table of minimum requirements of flight and on-duty time was adopted. This specified the various conditions of crew complement, and takes cognizance of on-duty time as an important factor in pilot fatigue. The resolution urged the adoption of single standards of working conditions, with a maximum of eight hours flight deck duty time in 24, unless adequate provisions for intermediate rest are provided. A reasonable relationship between flight time and on-duty time and a reasonable balance between days on duty and days free of all duty, with a minimum of 48 consecutive hours per week and eight days per 28-day period, at pilot's domicile.

AAL MEC at May 4 meeting.

New MEC's

All new MEC's have now been completed for the year 1955. Shown here are some as they met at ALPA's Home Office during recent months.

Pres. Sayen addressing UAL MEC.

The TWA MEC was held April 19-20.

Eastern Air Lines' MEC was held in late February.

Delta-C&S's MEC met at Home Office during late April.

UAL Auxiliary

J. C. Christie, head, Employment Agreements Department, addresses ALPA UAL Chicago Ladies Auxiliary during visit to Home Office.

Safety Standards

CAA Washington Representatives of Flight Test Branch meet with ALPA Safety Representatives at Home Office to discuss requirements for windshield visibility angles and proposed Modified Performance Standards.

Pension Plans

Below: PAA Retirement Committee at meeting held in early March. Right: TWA Pension representatives meet with Home Office staff on April 29.

▶ **Six-Month Proficiency checks:** Affirmed that such tests shall be primarily training flights, and if deficiencies exist, it is carrier's responsibility to provide sufficient training to enable the pilot to regain normal acceptable standards of proficiency.

▶ **Airport fire-fighting equipment:** Emphasized need for greater mobility and speed in fire-fighting units for reaching the fire scene and gaining access to passengers as rapidly as possible. Stressed need for more coordination and training with the primary emphasis on removing persons from the wreckage as quickly as possible.

▶ **Fuel storage in civil aircraft:** Recognized the problems of fuel storage resulting from modern aircraft design, but pointed out the added safety factor of separation of fuel from personnel compartments. Supported the encouragement of design characteristics recognizing this safety factor.

▶ **Alcoholic beverages in civil aircraft:** This subject created considerable discussion, with opposing viewpoints. The final action was a compromise of these viewpoints, but gave recognition to the problem and urged that, where appropriate, the consumption of alcoholic beverages be restricted to minimize the harmful eventualities of excessive use.

▶ **Amenities on board aircraft:** Recognized the deficiencies of personnel facilities on high density, long-haul aircraft. Recommended toilet compartments at a ratio of at least one for each 20 persons approximately, and on flights exceeding eight hours, provisions for separate crew facilities.

▶ **Licensing of Mechanics:** There is a trend in thinking toward licensing of the operator without requiring the individual mechanic to be certificated. The Federation condemned such practice, and affirmed that individuals should assume the responsibility of their personal certificate through the quality of their own work. The individual's skill, experience, and knowledge should be assessed and certificated by the governing agency, and not by the individual airline or operator.

▶ **Auto-feathering policy:** There was considerable support for IFALPA to rescind its policy relative to opposing credit for auto-feathering. Some member Associations thought that such a device was fundamental to the success of many modern aircraft. However, IFALPA's (and ALPA's) existing policy was sustained.

▶ **Radar Monitoring of ILS Approaches:** While it was recognized that excessive talking could be distracting to the pilot, it was the majority opinion that this was an American domestic problem. The Conference condemned the use of any GCA patter, which is excessive and not in accordance with the ICAO procedures.

▶ **Compliance with designated Instrument Landing procedures:** Pointed out the dangers of failure to comply with approved procedures, and directed all IFALPA members to examine their operating practices to insure that they conform with approved procedures.

▶ **Authority and prerogative of the pilot:** Discussed the derivation of authority and the legal implications arising therefrom. Directed that procedures be initiated which will define more clearly the authority of the pilot-in-command on an international basis.

▶ **Airport ground and approach aids:** There were a number of resolutions falling within this general category, with the greatest field of interest concerning international airports outside the United States. The action taken was primarily to furnish guidance standards for special working groups within IFALPA and ICAO dealing with these items.

▶ **Flight Rules:** It was agreed that the speed and operating altitudes made VFR unrealistic and undesirable for many flights because of the pilot's inability to see collision traffic in time to take corrective action. The Conference recognized that present ICAO VFR limits, in respect to visibility and cloud clearance, are inadequate, and urged the temporary adoption of 1000 feet vertical separation and three miles horizontal clearance from clouds. It also recommended the earliest possible adoption of IFR control for all flights above 15,000 feet.

▶ **Flight Recorders:** Recognized the statistical analytical benefits possible from proper use of flight recorders, while also appreciating the inherent danger of having such information misused for policing of flights. The Conference resolved to encourage the development and use of flight recorders, and to oppose the use of such information for policing of the conduct of flights since it cannot contain a record of pilot judgment.

▶ **Airworthiness Policy:** The policy relative to airworthiness was resolved with the primary emphasis upon an expression of dissatisfaction with the present trend in ICAO toward the elimination of numerical values in order to obtain a wider degree of international acceptance. The delegates thought this trend would result in meaningless airworthiness requirements, without any particular means of establishing requirement standards.

▶ **Life Jackets:** The possibility of forced landings in water near airports, not normally considered as being located near large bodies of open water, was discussed. The effect of life jackets and/or floatable debris on the loss of life in such event was considered. The Federation resolved to encourage the development and use of energy-absorbing and floatable accessories in all aircraft and the carriage of life jackets or other individual floatable devices in all aircraft.

▶ **Third Flight Crew Member:** One item discussed in plenary session, but not resolved by formal action, concerned the position of flight engineer. This matter was referred to member Associations for further study.

Not the least of the activities of the IFALPA Conference were the dinners and various social functions. The evening preceding the official opening of the Conference, the Canadian Air Line Pilots Association was host at a dinner and cocktail party at the Laurentian Hotel for all delegates and representatives, who had arrived for the Conference.

The next night all representatives, delegates and friends of the organization were entertained at a party at the Officer's Mess of the 417th Fighter Squadron, a service organization to which most of the Trans-Canada Airline pilots belong. On the third day, the Conference was recessed for a buffet luncheon, served in the Board of Directors' room at Canada-Aire, where all representatives and delegates to IFALPA were guests of the President and the officers of the company. Following the luncheon, we were taken for a tour of the plant through those portions where the Sabre-Jet and the T-33 were being built.

Conference activities and the limitations on time were the only factors preventing the IFALPA group from being entertained every single day. It was necessary to refuse, with regret, invitations of many other organizations and companies. The outstanding social activity of the entire Conference was the cocktail party and dinner given by the Canadian Air Line Pilots Association on the night of the 20th, following the adjournment of the Conference.

The many fine friends and pleasant contacts made during these social interludes would have made the entire trip worthwhile even if all the very

productive work in the sessions had not been accomplished.

The Next Conference

The 11th Annual Conference of IFALPA will be held in Rome, Italy, in February, 1956. Each Conference increases in importance for IFALPA, as well as for ALPA.

During the coming year, several international meetings, covering various phases of aviation, are scheduled. IFALPA has formulated policy on most of these subjects, and will have observers present at these meetings to present its policies. The 2nd Airworthiness Panel is meeting in Paris, France, at this time, where IFALPA will be represented throughout the three-week session. The action taken by these various working groups of ICAO will have a decided influence on the work of IFALPA and will determine many of the items appearing on the agenda for the 11th Annual Conference.

Conclusions

ALPA is vitally concerned with international aviation. We gain much strength from international endorsement of policies established by ALPA. The American Air Line Pilots Association does not dominate the International Federation in any way. It, nevertheless, commands considerable prestige and influence by virtue of its size and organizational structure. When ALPA action or policy is adopted by IFALPA, it is due to the soundness of the policy and to the background of preparation for the resolutions.

We rather complacently accept ALPA participation in such activities as Annual Reviews, Airspace Subcommittees, Accident Investigations and Hearings, ATA Chief Pilots Meetings, Noise Abatement programs, Revision of Civil Air Regulations, etc., without much thought as to the implications of such participation. This participation has developed through years of conscientious and productive activity by staff members and pilot special representatives of ALPA. The Association has always been acutely aware that such participation also carries a tremendous responsibility to the rest of the aviation industry.

No other member Association has achieved a position within their country's aviation industry to even approach that of ALPA. This representative from ALPA was quite surprised, for example, to learn that pilots from other Associations can contribute practically nothing toward an accident investigation, and are usually not even allowed to approach the scene of an airline accident. Pilot participation in the official investigation is not even considered.

The exchange of ideas and information throughout the Federation can benefit all of the aviation industry. Not only do member Associations gain knowledge useable in advancing the needs and desires of its members, but the other components of the aviation industry learn of the mutual advantages to be obtained by utilizing the consumer knowledge and professional evaluation available from the airline pilots.

Here lies the future, the strength and the effectiveness of the International Federation of Air Line Pilots.

The Human Element

Why Blame The Pilot If 'Gimmicks' Go Haywire?

Reprinted from The Aeroplane

A great deal has happened in aviation during the past decade or two, but many of the changes have come about so gradually that few people have noticed them.

One of these less perceptible changes has concerned the public's, and even the air transport industry's, attitude towards the air line pilot and his work. He is still, as always, deeply respected by his passengers for his obviously great experience and for his ability to deal successfully with a complicated piece of machinery. But whereas, in the inter-war years, he was looked upon by his passengers as the man who was personally doing his best in extremely difficult circumstances to look after their safety and well-being—and was thus more readily forgiven for occasional lapses in technique—he is now accepted much more as a competent technician who should do no wrong. Faith in aircraft and in the science of aircraft operation has partly removed the need for faith in simple human judgment alone.

From the point of view of an air line's economics this is an essentially excellent public frame of mind. How otherwise could the traffic people expect timid old ladies to climb serenely aboard an aircraft which is just about to be taken off and climbed away into a sleet-filled gloom?

Statistically Safe

Passengers have travelled happily by train and by boat, and are now travelling by air, because the vehicles concerned have unconsciously been approved as being reasonably safe on a statistical basis.

But those in the business of making civil aircraft and of operating air lines should not allow themselves to forget the uncomfortable fact that, when it comes to the point, the safe arrival or departure of an aircraft is still very much a potential accident which has been averted by a skill which is all too blandly accepted. The surprising thing is not that there should occasionally be accidents which may have been caused, or contributed to, by human error, but that there should be so relatively few of them.

The airworthiness authorities see to it that modern civil aircraft have no serious handling vices in the old-fashioned sense; though complicated in their operation, these modern aircraft are essentially easier to fly than most of the aircraft which were current during the inter-war years. But the weather minima and the various navigational aids have taken up any slack there might have been. After an instrument let-down, a pilot is confidently expected to complete to perfection a final visual approach and landing during a period of time covering a very few seconds.

Narrow Margins

This is no more than the air line pilots have been trained and paid to do with reasonable proficiency from day to day. But it is absurd, since we have set them a difficult task, to raise our eyebrows when one of these perfectly normal, human creatures fails for once to pull it off successfully.

Since we seem to be committed, in

(Continued on Page 14)

An ALPA Appraisal Of Crash Fires

With Jet Transports Here, Horse-And-Buggy Airport Equipment, By Contrast, Still Leaves Us Stuck With Yesterday's Outmoded Fire-Fighting Methods

By Theo. G. Linnert
Head, ALPA Engineering Dept.

Airplane development and increased acceptance of air travel will add to the already extensive activities of "crash-fire" researchers in establishing proper safeguards against the loss of life and property by fire. Recognizing the importance of these facts this article will attempt to state the "Air Line Pilots Appraisal of the Crash-Fire Problem."

Crash-Fire Hazard

To evaluate the need for today's requirements for the best in airport fire fighting equipment and trained personnel, it is well to go back a few years in aviation. In early aviation, since landing or take-off speed was approximately 50 miles per hour, an accident due to a landing gear failure, ditches or airport conditions, etc., usually resulted in the airplane spinning around a bit. A broken propeller or even major damage to the aircraft resulted, but usually not to the extent of a crash-fire. Airliners were small, and carried small quantities of fuel, never too much. After World War I, we were in the barn-storming era and early air travel development stage.

With the appearance of DC-3 and Lockheed twin-engine airliners we approached higher ground contact and take-off speeds. Landing and take-off accidents that sometimes resulted in a crash fire began appearing, with the resultant need for better fire fighting equipment.

Shortly before and after World War II, there arrived the real start of the transport airplane and greatly increased acceptance of air travel by the public. Large high speed airliners with large fuel quantities rapidly developed, demanding more power for more speed and load carrying ability. With more power, more fuel is required. Today a long-range airplane takes off at approximately 25 per cent of its gross weight being fuel, or one out of every four pounds.

Obviously with the development of the modern fast airliner came the need for the most modern in fire fighting machines, techniques and the best in trained fire fighting crews, for successfully subduing or controlling a crash-fire following an accident of the survivable type.

Cost Of Modern Equipment

Of course, money is the obstacle in regard to purchasing modern aircraft fire fighting equipment and manning the equipment with trained crews, but ALPA recommends a look at the long-range viewpoint. Today, more than ever before, we are able to look ahead and say that today's jet and turbo-prop transports will be used for approximately 25 years. These subsonic turbine powered transports are being designed to fit into the pattern of today's airport operational requirements. These new transports will have the same crash-fire problems that today's transports have. Therefore, we can say that today's fire fighting equipment at its best can remain effective for approximately 25 years.

Many men with inferior tools are almost useless in subduing the fire on a large burning airliner. Pilot representatives studying the crash-fire fighting problem learned that up-to-date fire fighting equipment manned by two men can do the work of dozens with the old type equipment. It is purely technological advancement that makes this possible.

An obsolete fire truck manned with six men compared to up-to-date equipment manned by two men can result in the following figures:

▶ **Obsolete Equipment:** Six men required for an eight hour shift with three shifts per day requires 18 men for 24 hour coverage of the airport fire station. Eighteen men at an assumed salary of $4,500 per year amounts to $81,000 per year.

▶ **New Equipment:** Two men required for an eight hour shift with three shifts per day requires six men for 24 hour coverage of the airport fire station. Six men at an assumed $4,500 per year salary amounts to $27,000 per year.

It can readily be seen that up-to-date equipment available at approximately $25,000 per unit, can, in about one-half year be paid for by the money saved in salary of requiring more men with obsolete equipment. In addition to the savings in cost, up-to-date equipment is, of course, more effective and can do the job.

It is difficult to accurately assess the exact cost, but what is needed is not manpower which is expensive, particularly over a period of years, but a combination of the best in fire fighting machinery, and this, like all up-to-date machinery, makes possible doing a better job with less manpower and cost.

ALPA Survey

The ALPA Crash-Fire Committee that has been making a study of aircraft crash-fires and the means of preventing or fighting them, had this to say at the 1954 Air Safety Forum:

"First let us make one thing perfectly clear, that most aircraft fires can be extinguished if reached in time by experienced personnel with adequate modern up-to-date equipment. Many people do not believe this statement to be true, but we are convinced that if the crash has been such that occupants are still alive, then the fire can be controlled.

"Many of the airports into which the commercial airlines operate are also used by the Air Force Reserve, National Guard or Navy. At every such airport very excellent crash equipment is provided. In some of our major commercial airports such as Washington, New York, Miami or Fort Worth to name a few, we find also that the local authorities have provided an adequate amount for crash-fire protection.

"The ALPA Crash-Fire Committee has met with Airport Managers, Fire Chiefs, and city officials throughout the country. At one large airport in the northeast, currently being used by Constellation and DC-6 equipment, there is one antique fire truck that has not been used for many years. In fact, it is covered with dust. The Fire Department consists of untrained and inexperienced mechanics and ground personnel of the airline. Most of the time the entrance to the Fire Department is completely blocked by heavy ramp equipment.

"At one of the ten largest airports in the country, there are three obsolete crash trucks. At the time of our first

inspection, even the hoses were full of holes. During discussion with the airport manager, he stated that there had not been a crash at his airport for the last 25 years and he saw no reason for having one in the future and he considered crash equipment a waste of airport profits.

"At one of our large airports, also one of the ten largest in the country, the airport Fire Department is a part of the city fire service with a large number of well-trained personnel available. However, they had one used crash truck sold to them at the end of the war by the Air Force for $1.00. The fire chief has twice requested new equipment from the city's Aviation Committee and has been turned down on both occasions. He was obviously concerned that in the event of a crash-fire at his airport that he could not effectively control the fire."

Although the ALPA Crash-Fire Study Committee covers only a few situations they found in their airport survey, it goes without saying that there is room for much improvement.

Emergency Communication

Since pilots turn off the electric current following a survivable crash and thereby cannot communicate by radio with the tower, consideration should be given to develop ways and means of assuring speedy communication between tower personnel, flight crew and fire department, particularly during marginal weather. The following facts were obtained from accident investigation participation by ALPA accident representatives:

▶ During a landing with restricted visibility conditions, damage to the landing gear and wing structure resulted in severe damage to fuel tank area to the extent that gasoline fumes were soon detected by the crew. Immediately the crew shut off all engines and electric current and successfully prevented a fire, even though the airplane remained in a normal attitude and could still be taxied. The airplane was soon surrounded by a pool of gasoline. The captain reported "arrival of the fire fighting equipment took place in approximately 27 minutes."

▶ Another case is on record where a nose wheel collapsed due to striking a snow bank. Again the flight crew shut off all electrical current to prevent a crash-fire. A ten-minutes period of time elapsed before fire fighting equipment arrived on the scene.

▶ Other cases of landing gear failure and "overshoot" type accidents revealed that improved procedures are needed to assure that once the pilots turn off the electric current following a survivable crash and thereby cannot communicate by radio with the tower, fire fighting equipment arrival should be assured in the shortest possible time.

The record shows that generally delayed arrival of the fire fighting equipment occurs only at such times when the airplane cannot be seen by the control tower. This, of course, is possible only when weather is around 200 feet and ½ mile or 300 feet and ¾ mile. It is under these weather conditions that we have had many accidents. Fortunately during only a small portion of the time per day or per year, such restricted visibility conditions exist in most areas. This suggests that for such weather conditions we should have a fire department setup that closely monitors tower and pilot conversation. If the landing plane does not report a short time after touch-down, the fire department having heard the tower contacts with the airplane can be on their way toward the active runway end. Having monitored the progress of the flight to the landing strip by listening to the tower contacts with the pilot, the fire department will know the runway being used. This information in itself can save time.

The tower-pilot monitoring burden on the fire department will not be too great, since flight operations during such marginal weather to the extent that the airplane cannot be seen by the tower will seldom occur, and usually be of short duration. We have recently discussed this with the airport fire department personnel of a large city and it is considered that this idea has merit. We urge that in the interest of safety all possible causes of delay in communication between the tower and fire department be studied when the weather is so marginal that the tower cannot observe the taking off or landing airplane to the end of the runway.

Fire Fighters' Problems

In addition to the ALPA Crash-Fire Study Committee other pilots inform us that their visits with airport fire department personnel indicate a lack of understanding of airplane design features for evacuation purposes and knowledge of potential ignition sources, associated with damaged airplanes.

The fire fighters must have knowledge of the airplane "makeup" and the likely fire break-out points, etc., to give them courage to "move in" to prevent fire and also act effectively to control or subdue a "crash-fire."

To speed up and take out the guess work, a recommendation, which we endorse that came from one fire department, is to conspicuously paint relatively large letters of instructions on the emergency exits, chop marks, etc., and frame these instructions in light-reflecting paint so they can be found rapidly during the hours of darkness.

Passenger Information

Last year approximately 35 million airline tickets were purchased. That is ten times more tickets than were sold ten years ago. Fear of flying is decreasing.

We can expect the air travelling public to react favorably and intelligently to safety information when it is offered to further benefit their best interest. We refer to providing the air travelling public with some literature located in the passenger seat relative to the emergency evacuation means designed into the airplane.

Very few airlines have comprehensive literature, that informs the passenger that for their added protection certain emergency escape means have been designed into the airplane. We believe such information would be appreciated by the passengers and enable them to speed up evacuation of the cabin. This would permit added time for the crew to handle other problems until the airport fire department arrives. Further, the fire department rescue work would be reduced by the evacuation "self-help" provided by the passengers.

Application Of Research

The fact that we must make headway in the reduction of fire hazards associated with minor accidents by the application of improved airplane design and emergency evacuation requirements is receiving greater recognition by the industry.

The fine work of NFPA, CAA-TDEC, FSF, NACA and others should be given the greatest support. Improved airplane design knowledge that these highly qualified organizations develop to reduce the crash-fire potential, should be promptly recognized, and adopted to the greatest possible extent by aircraft design and operating people.

Storage of fuel as far as practical from the passenger compartment is an important design item receiving considerable attention. Association crash-fire accident analysis study resulted in the 13th ALPA Convention adopting this resolution: *"that in the interest of safety, the Association adopt the policy that highly volatile fumes for fixed wing aircraft should be limited to areas*

away from said aircraft's fuselage and/or compartment which contain passengers and/or crew."

This resolution is receiving considerable support from highly regarded airplane safety design specialists.

The CAA Technical Development & Evaluation Center has a fine program for reducing a crash-fire possibility when an accident of the survivable type occurs. The CAA program has developed to the point where they know a crash-resistant tank design is practical and economically feasible. Their next step is automatically sealing the tank outlets. This step is also considered practical and economically feasible. When design requirements for crash-resistant tank and automatically sealing fuel tank outlets are developed, there should be prompt support by the industry to adopt these features.

By the record, there is evidence that entirely too much time elapses in the adoption of known ways and means to increase the efficiency and safety of aviation.

Crash Fire Accident Prevention

We believe we would be remiss not to dwell on the fact that many survivable accidents that are occurring over and over again are preventable accidents. There are survivable accidents occurring, considered due to an act of God and human and material failure, that substantiate maintaining the best in fire fighting equipment. In addition, the pilots claim drastic lack of airport safety requirements are causing the survivable type accidents to occur all too frequently. Let us see what the records show to support the pilots' claims.

Our records, which we know are not 100 per cent complete, but adequately representative to prove the point that airport safety requirements are drastically lacking, point up the following:

- Lack of adequate approach lights.
- Lack of runway marking.
- Lack of friction on runway surfaces.
- Ditches near the runway ends.
- Close-in hazardous obstructions.
- Sharp rises at the approach ends of runways.

Getting back to the lack of adequate approach lights, ALPA representatives testified at six CAB accident hearings that adequate approach lighting would have prevented the accident. In these accidents 47 lives were lost as well as millions of dollars of equipment during a time period of approximately eight years.

Ditches near runway ends have caused the loss of nine lives in seven accidents of the survivable type during a time period of approximately eight years. One drainage ditch near the end of one runway caused the wreck of two airliners and one military airplane. *After* these accidents the ditch was covered over so that a plane can roll beyond the runway a few feet without a disaster.

Recently, at one of our new modern airports, during heavy rain accompanied by a wind shift, an "overshoot" accident occurred. Fortunately, the pilot succeeded in a ground-loop just in time to prevent plunging into a gully. This gully can easily be filled with soil.

"Close-in" hazardous obstructions have caused their share of accidents and "close-calls." Recently, at one of our large airports, an accident occurred due to an airline's nose wheel being broken off due to striking the airport fence, which was near the approach end of the runway. *After* the accident the fence was moved and lowered. Why was it so close to the runway end in the first place? Fences are needed, of course, but why do they have to be made so strong? The fence manufacturer can advertise that their fence was struck by an airliner and remained relatively intact, but the airliner was wrecked. The question is, how many more strong fences do we have near the approach ends of the runway? Why can't they be frangible. The balance of the airport boundary fence can be as strong as desired.

Smoke Stack Obstacle

The top of a smoke stack was struck by an approaching airliner. A few of the bricks were knocked off. *After* the accident it was determined that the stack was not used for years. It is now torn down.

A difference in the grade between the airport level and the runway level has caused repeated accidents. In one case a large airliner landed on the airport, but approximately 130 feet short of the runway. The runway had a sharp rise of about five feet above the airport soil. The landing gear upon striking this abrupt rise was broken off. The plane burned and seven were lost.

After the accident 2,000 cubic yards of dirt at 50 cents per yard were used to level the runway end with the airport. One thousand dollars could have prevented the loss of seven lives and a million dollar airplane. Six other airliners suffered severe damage due to striking an abrupt rise near the approach runway end with only luck preventing fatalities.

We believe that organizations such as the NFPA and others, which are working toward saving lives and property by improving the chances of surviving an airplane accident of the survivable type, should also give consideration to eliminate the cause of the accident. The NFPA, for example, fostered fire codes that the fire departments enforce to eliminate all known fire hazards to protect the U. S. citizens in their place of work and their homes.

We believe the accident record substantiates that these organizations, while continuing their commendable efforts to make possible surviving a crash-fire following a survivable accident, should also do all they can to obtain the airport improvements to prevent the possibility of a crash-fire from occurring.

Formulating a code for airport safety for preventing the survivable type accident from occurring would be a great step forward.

The Human Element . . .

(Continued from Page 11)

air transport, to somewhat narrow margins of safety in terms of wing loadings, runway lengths and weather minima in relation to available scientific aids, we can only try to be sensible about it. We must accept the occasional human error accident without too much complaint—fitting the results statistically into the safety margins laid down—and, at the same time, see what we can do to reduce the possibility of error by providing more effective aids.

But these should be "aids" and not "automatics." The "black box" is, by itself, rather worse than useless as a prospective means of reducing accident rates. For all its frailties, a living creature is, with its almost infinite number of standby circuits, superior in every way to any electronic or automatic device. When the "black box" goes sick, it either fails altogether or, worse still, produces, without a twinge of conscience, a series of completely false answers; the sick living creature at least makes an intelligent attempt to do the job it originally intended to do.

However, there is one thing which the "box" can do, when it is working properly: it can improve on any human performance in its accuracy and speed of reaction. Unaffected as it is, by emo-

tional complications, it can, so long as there is no failure, do everything perfectly in its own limited field.

Fortunately, too, the human being has always been better as an occasional critic than as a day-to-day actor. He is, consequently, a very good monitor of other people's work or, in this case, of the work of slave devices of various kinds. So we have a prospectively perfect complementary setup, which should be fully explored and developed.

Let's Look Further

Meanwhile, let us try to stop treating, even in our minds, the occasional but inevitable human failure of a pilot as if it were some quite unjustifiable and even incomprehensible lapse in normal behavior. If we can do so, there may be some hope of progress following findings, often after accidents, which have been fatal to the pilot, that the fault was due to "error of judgment." We might reach the stage where such an "error of judgment" could be accepted as being on the part of certifying, specifying and designing authorities who had come to place too much reliance on the human element.

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What's Ahead In Cockpit Design . . .

(Continued from Page 4)

4. The program must be conducted by a team of pilots, human engineers, engineering physicists, and engineers. The pilots state the data they need, the human engineers establish how the pilots should receive the data, the engineering physicists determine the technical requirements for the controls and display, and the engineers implement the technical requirements. The final conclusions will be made when the pilots determine by test whether the information requirements have been met.

5. The cockpit, pilot, instruments, controls, and associated equipment, must be treated as a completely integrated system, each element affecting the design of all other elements.

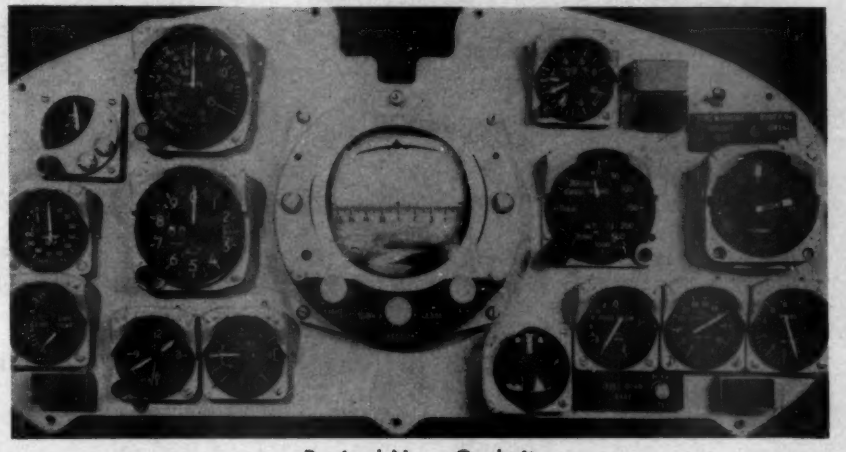
6. Each piece of equipment regardless of how small a part it plays must be designed on the basis of fundamental requirements rather than on personal opinion or the fact that it is a 'standard' item.

If this approach is followed, there is no reason to doubt that an air line cockpit of the future can be developed, which will permit truly all-weather operation because the pilot will be performing at peak efficiency with totally reliable equipment with a minimum of training, and the aircraft will be carrying a maximum payload.

An air line can only be as efficient as the pilots who fly its planes.

Pilots can only be as efficient as their equipment will permit.

Standard Navy Cockpit



Revised Navy Cockpit

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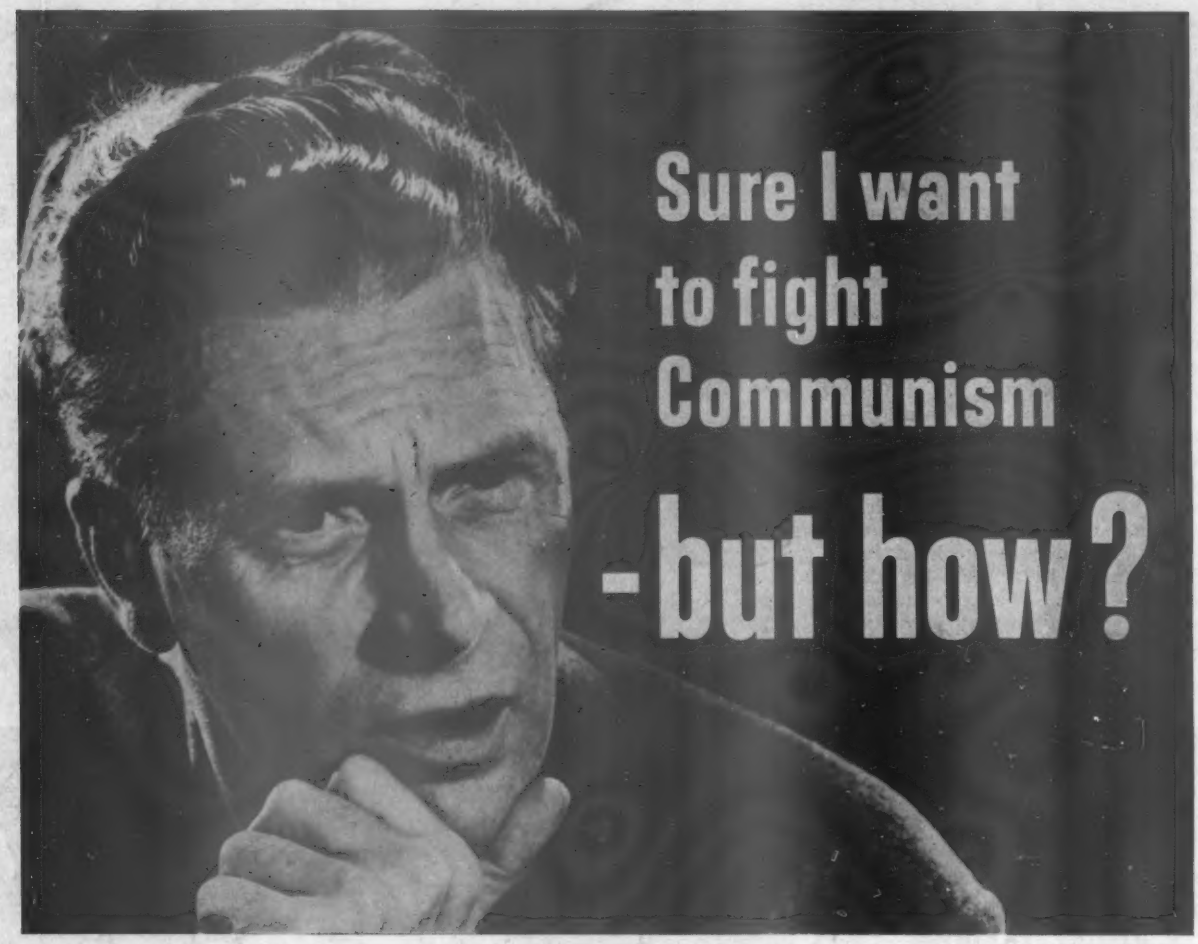

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